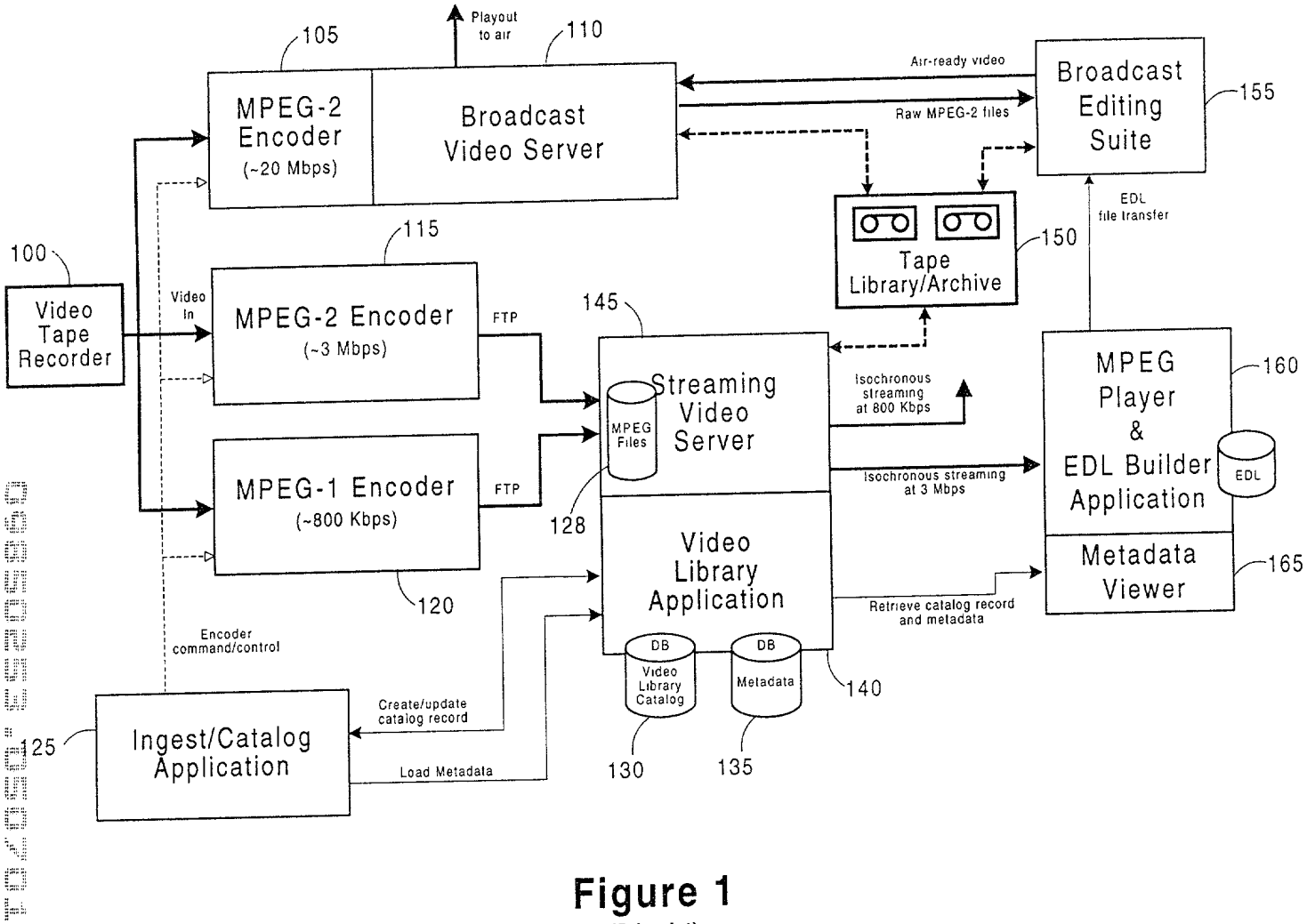



**Figure 1**
(Prior Art)

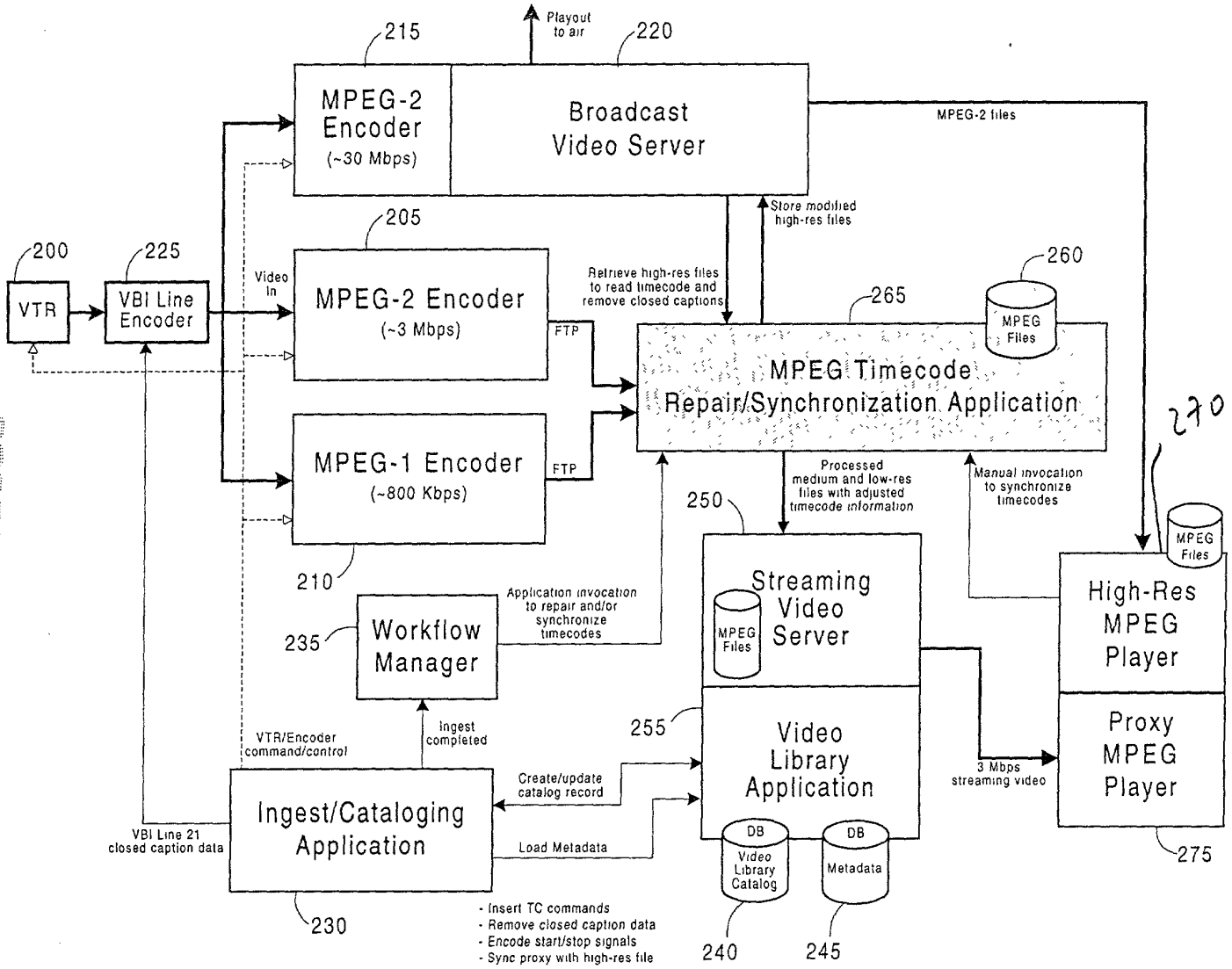

Playout to air
215
220
MPEG-2 Encoder (~30 Mbps)
Broadcast Video Server
MPEG-2 files
Store modified high-res files
205
200
225
260
VTR
VBI Line Encoder
Video In
MPEG-2 Encoder (~3 Mbps)
Retrieve high-res files to read timecode and remove closed captions
265
MPEG Files
FTP
MPEG Timecode Repair/Synchronization Application
270
MPEG-1 Encoder (~800 Kbps)
FTP
Processed medium and low-res files with adjusted timecode information
Manual invocation to synchronize timecodes
250
MPEG Files
210
Application invocation to repair and/or synchronize timecodes
Streaming Video Server
High-Res MPEG Player
235
Workflow Manager
MPEG Files
Ingest completed
255
Video Library Application
Proxy MPEG Player
VTR/Encoder command/control
Create/update catalog record
3 Mbps streaming video
VBI Line 21 closed caption data
Ingest/Cataloging Application
Load Metadata
DB
Video Library Catalog
DB
Metadata
275
230
- Insert TC commands
- Remove closed caption data
- Encode start/stop signals
- Sync proxy with high-res file
240
245

**Figure 2**

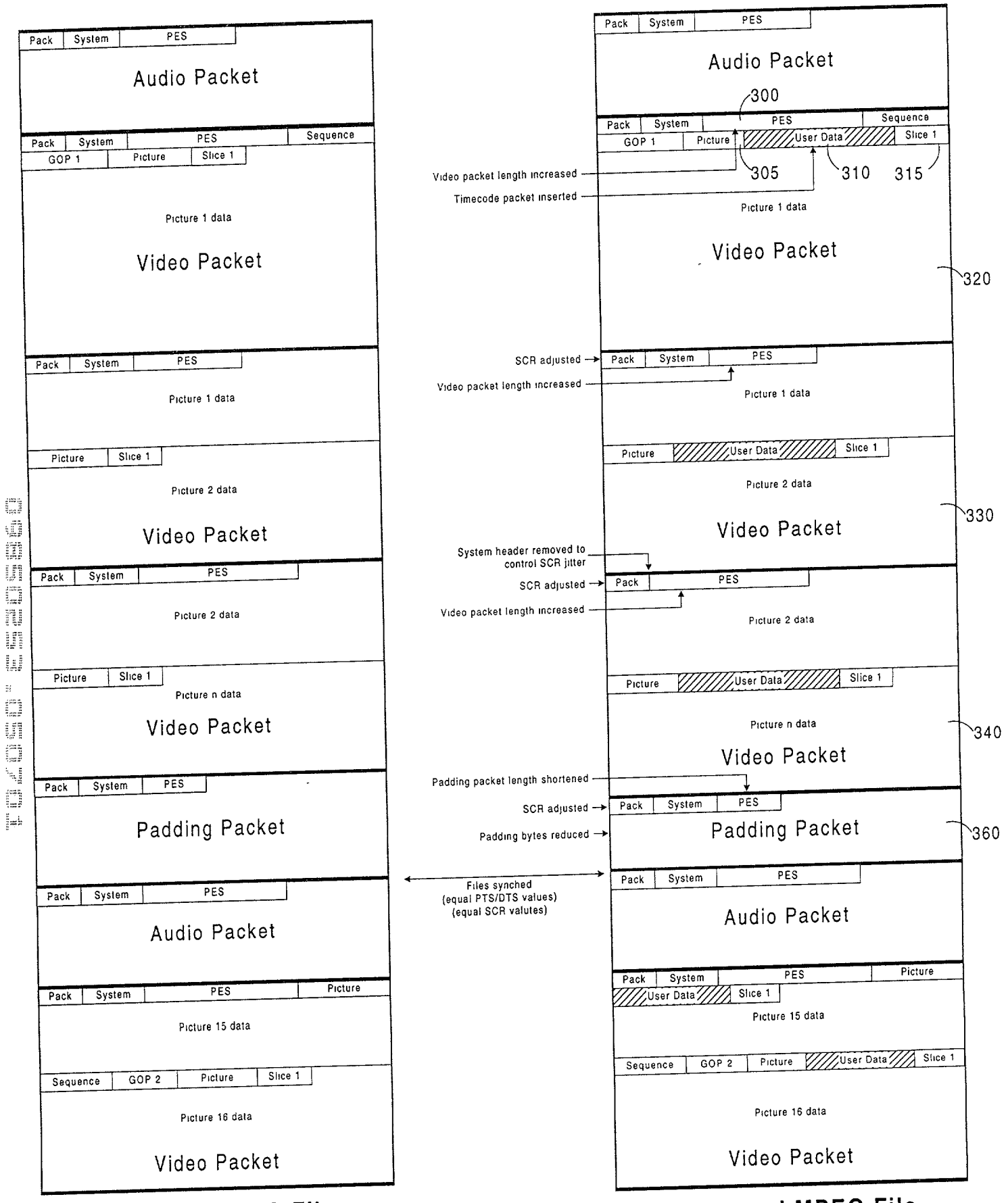
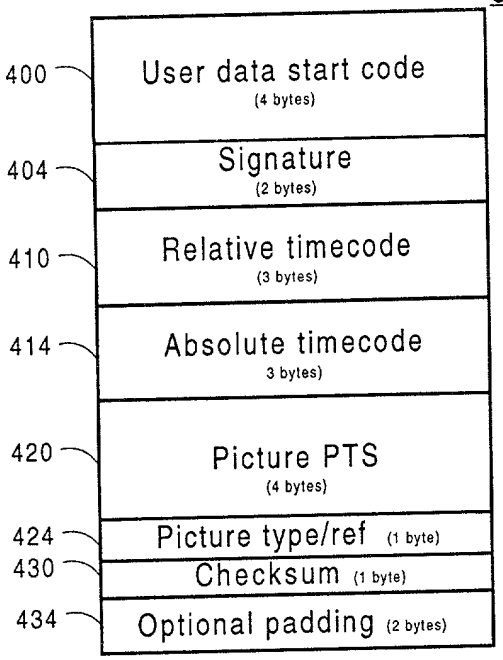

Pack
System
PES
Audio Packet
Sequence
GOP 1
Picture
Slice 1
Picture 1 data
Video Packet
Picture 2 data
Picture n data
Padding Packet
Picture 15 data
Sequence
GOP 2
Picture 16 data
User Data
300
305
310
315
320
330
340
360
Video packet length increased
Timecode packet inserted
SCR adjusted
System header removed to control SCR jitter
Padding packet length shortened
Padding bytes reduced
Files synched
(equal PTS/DTS values)
(equal SCR valutes)
Original MPEG File
Processed MPEG File

Figure 3

## Timecode Packet




| Offset | Format | Value |
|---|---|---|
| 0 | 0000 0000 | 0x00 |
| 1 | 0000 0000 | 0x00 |
| 2 | 0000 0001 | 0x01 |
| 3 | 1011 0010 | 0xB2 |
| 4 | 1010 1010 | 0xAA |
| 4 | 1010 1GGP | 0xA8 |
| 6 | BHHH HHMM | |
| 7 | MMMM SSSS | |
| 8 | SSXF FFFF | |
| 9 | NHHH HHMM | |
| 10 | MMMM SSSS | |
| 11 | XSSF FFFF | |
| 12 | PPPP PPPP | |
| 13 | PPPP XPPP | |
| 14 | PPPP PPPP | |
| 14 | PPPP PPPP | |
| 16 | PTTR RRRR | |
| 17 | CCCC CCCC | |
| 18 | 1111 1111 | |
| 19 | 1111 1111 | |

### Legend

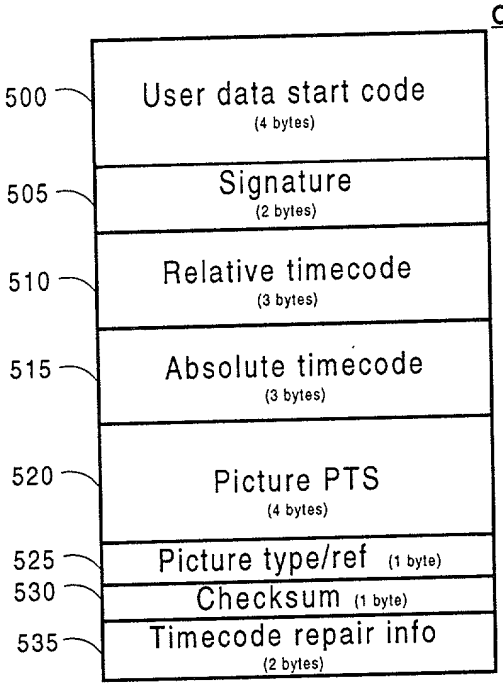
X = Markers
H = Hours
M = Minutes
S = Seconds
F = Frames
G = Rights flags
P = PTS
T = Picture type
R = Picture reference
C = Checksum
B = Thumbnail taken flag
N = No matching hi-res flag

### Rights Flags

00 = Full rights
01 = Limited rights
10 = No rights
11 = Rights expired

**Figure 4**

## Introductory Timecode Packet




| Offset | Format | Value |
|---|---|---|
| 0 | 0000 0000 | 0x00 |
| 1 | 0000 0000 | 0x00 |
| 2 | 0000 0001 | 0x01 |
| 3 | 1011 0010 | 0xB2 |
| 4 | 1011 1011 | 0xBB |
| 5 | 1011 1GGP | 0xB8 |
| 6 | BHHH HHMM | |
| 7 | MMMM SSSS | |
| 8 | SSXF FFFF | |
| 9 | NHHH HHMM | |
| 10 | MMMM SSSS | |
| 11 | XSSF FFFF | |
| 12 | PPPP PPPP | |
| 13 | PPPP XPPP | |
| 14 | PPPP PPPP | |
| 15 | PPPP PPPP | |
| 16 | PTTR RRRR | |
| 17 | CCCC CCCC | |
| 18 | UVYY XXZZ | |
| 19 | ZZZZ ZZZZ | |

**Legend**

| | |
|---|---|
| X = Markers | P = PTS |
| H = Hours | T = Picture type |
| M = Minutes | R = Picture reference |
| S = Seconds | C = Checksum |
| F = Frames | B = Thumbnail taken flag |
| G = Rights flags | N = No matching hi-res flag |
| Y = Timecode flags | U = Truncated proxy start flag |
| Z = Proxy offset | V = Truncated proxy end flag |

| Rights Flags | Timecode Type |
|---|---|
| 00 = Full rights | 00 = Original source TC |
| 01 = Limited rights | 01 = Repaired TC |
| 10 = No rights | 10 = House TC |
| 11 = Rights expired | 11 = Elapsed TC |

**Figure 5**

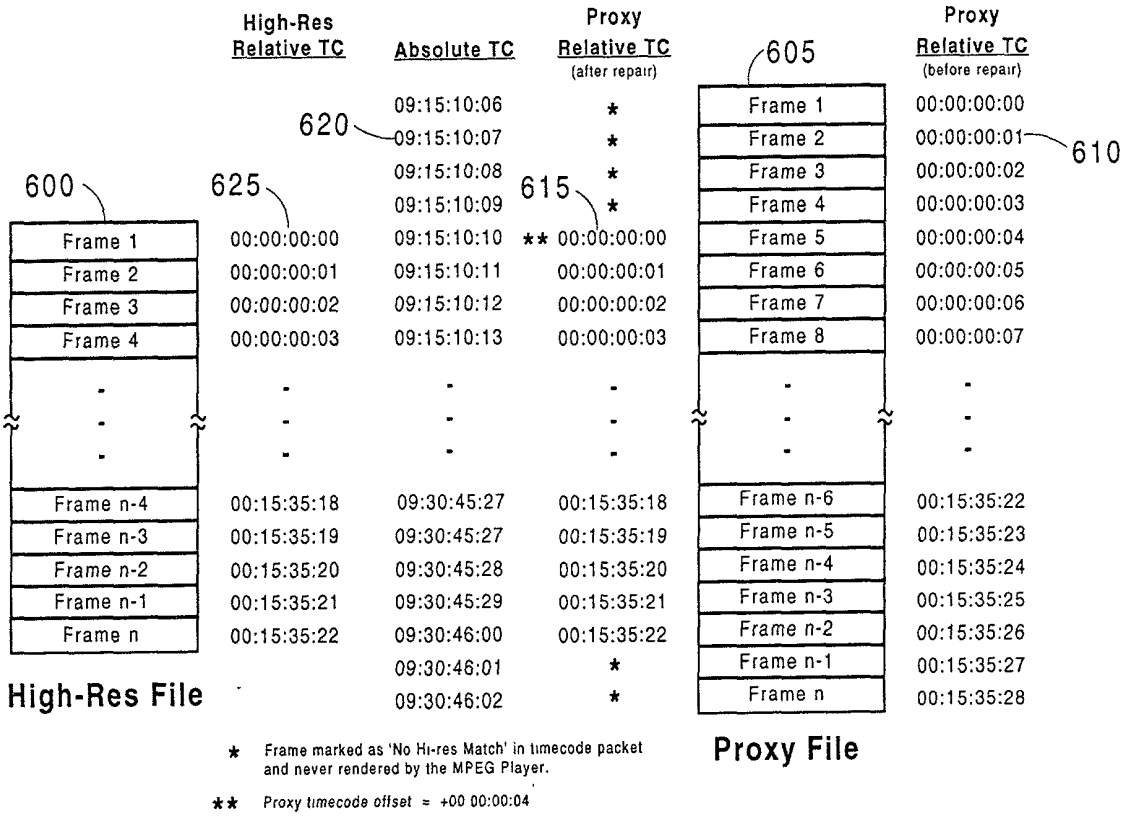
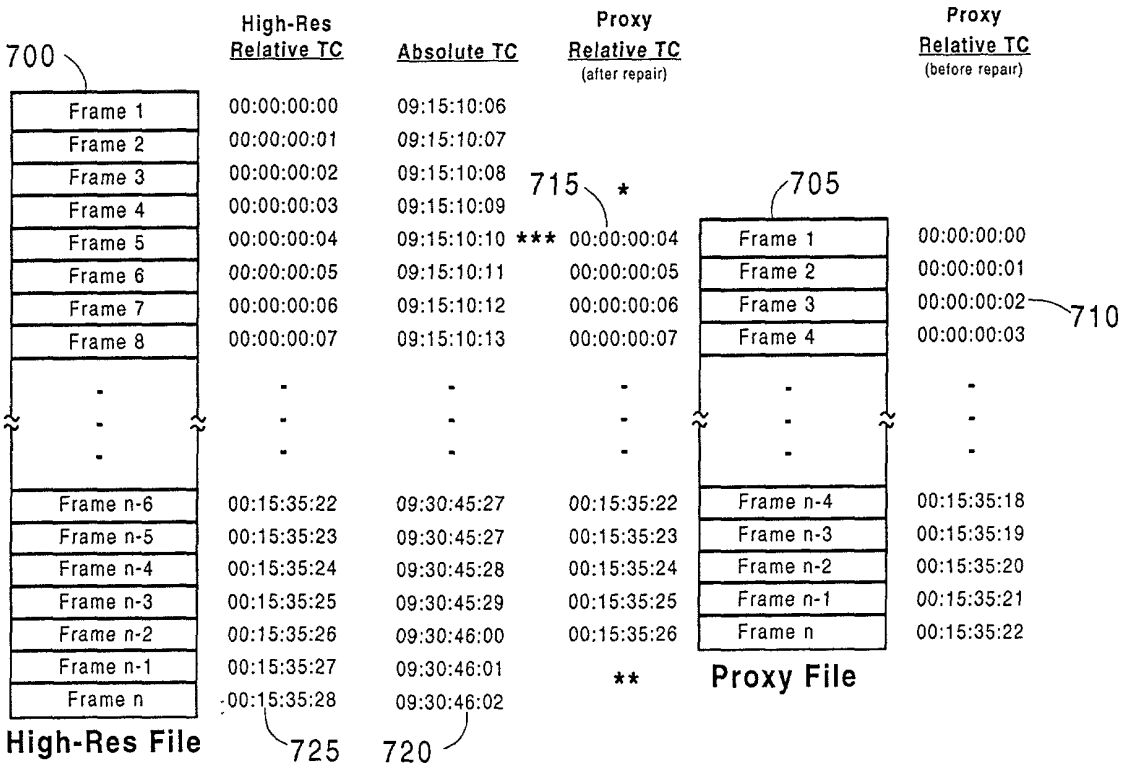

600
625
620
615
605
610
High-Res Relative TC
Absolute TC
Proxy Relative TC (after repair)
Proxy Relative TC (before repair)
Frame 1
Frame 2
Frame 3
Frame 4
Frame n-4
Frame n-3
Frame n-2
Frame n-1
Frame n
00:00:00:00
00:00:00:01
00:00:00:02
00:00:00:03
00:15:35:18
00:15:35:19
00:15:35:20
00:15:35:21
00:15:35:22
09:15:10:06
09:15:10:07
09:15:10:08
09:15:10:09
09:15:10:10
09:15:10:11
09:15:10:12
09:15:10:13
09:30:45:27
09:30:45:27
09:30:45:28
09:30:45:29
09:30:46:00
09:30:46:01
09:30:46:02
*
*
*
*
** 00:00:00:00
00:00:00:01
00:00:00:02
00:00:00:03
00:15:35:18
00:15:35:19
00:15:35:20
00:15:35:21
00:15:35:22
*
*
Frame 1
Frame 2
Frame 3
Frame 4
Frame 5
Frame 6
Frame 7
Frame 8
Frame n-6
Frame n-5
Frame n-4
Frame n-3
Frame n-2
Frame n-1
Frame n
00:00:00:00
00:00:00:01
00:00:00:02
00:00:00:03
00:00:00:04
00:00:00:05
00:00:00:06
00:00:00:07
00:15:35:22
00:15:35:23
00:15:35:24
00:15:35:25
00:15:35:26
00:15:35:27
00:15:35:28
High-Res File
Proxy File
* Frame marked as 'No Hi-res Match' in timecode packet and never rendered by the MPEG Player.
** Proxy timecode offset = +00 00:00:04

Figure 6




* 'Truncated proxy start' flag set in timecode packet to alert user that not all frames in the high-resolution file can be browsed.

** 'Truncated proxy end' flag set in timecode packet

*** Proxy timecode offset = -00 00.00 04

**Figure 7**

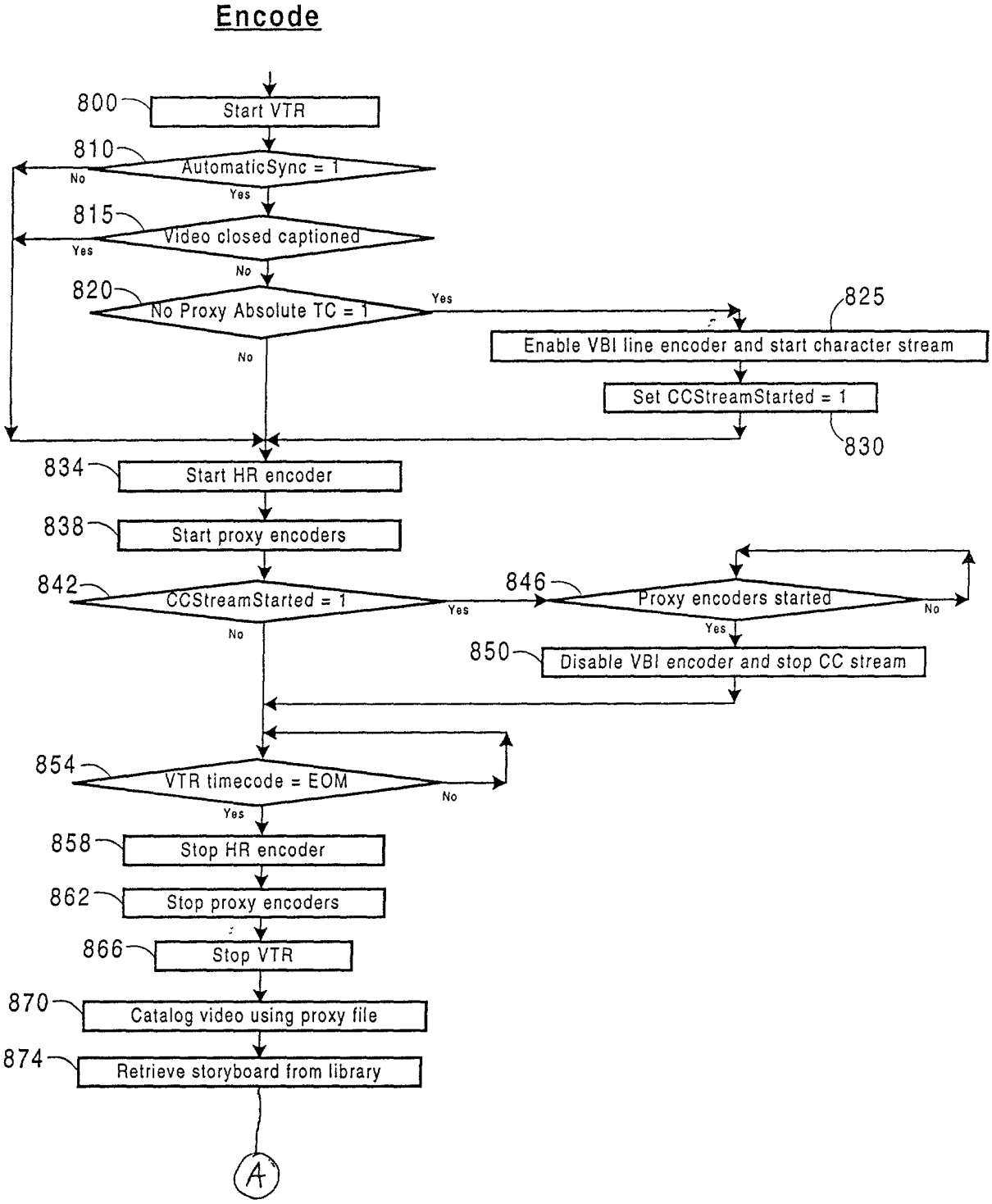

Encode
800
Start VTR
810
AutomaticSync = 1
No
Yes
815
Video closed captioned
Yes
No
820
No Proxy Absolute TC = 1
Yes
No
825
Enable VBI line encoder and start character stream
Set CCStreamStarted = 1
830
834
Start HR encoder
838
Start proxy encoders
842
CCStreamStarted = 1
Yes
No
846
Proxy encoders started
No
Yes
850
Disable VBI encoder and stop CC stream
854
VTR timecode = EOM
No
Yes
858
Stop HR encoder
862
Stop proxy encoders
866
Stop VTR
870
Catalog video using proxy file
874
Retrieve storyboard from library
A

Fig. 8A

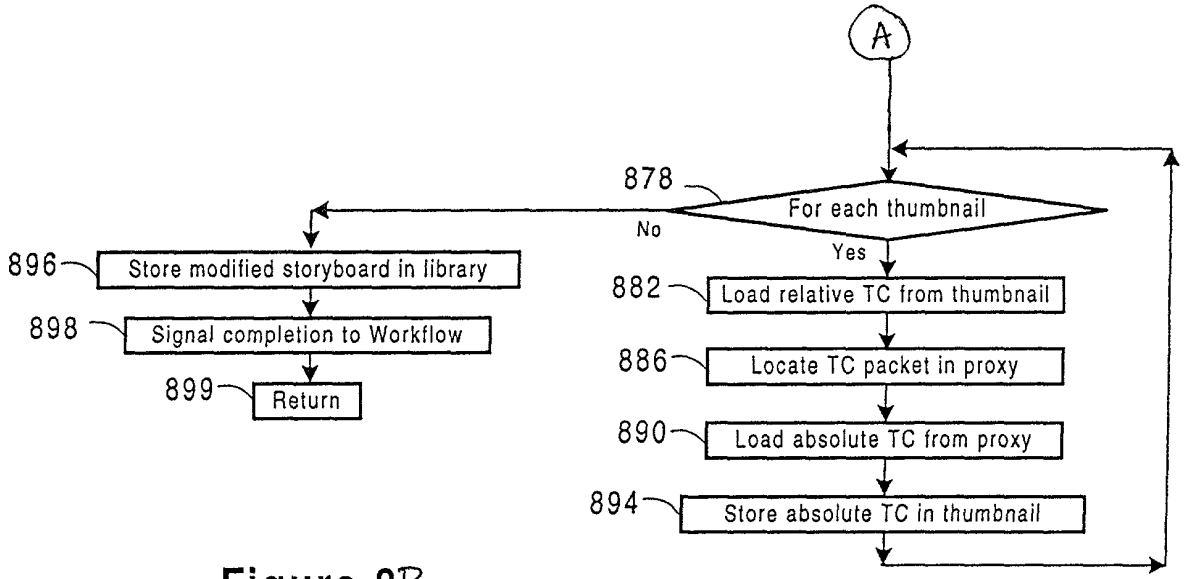

A
878
For each thumbnail
No
Yes
896
Store modified storyboard in library
898
Signal completion to Workflow
899
Return
882
Load relative TC from thumbnail
886
Locate TC packet in proxy
890
Load absolute TC from proxy
894
Store absolute TC in thumbnail

Figure 8B

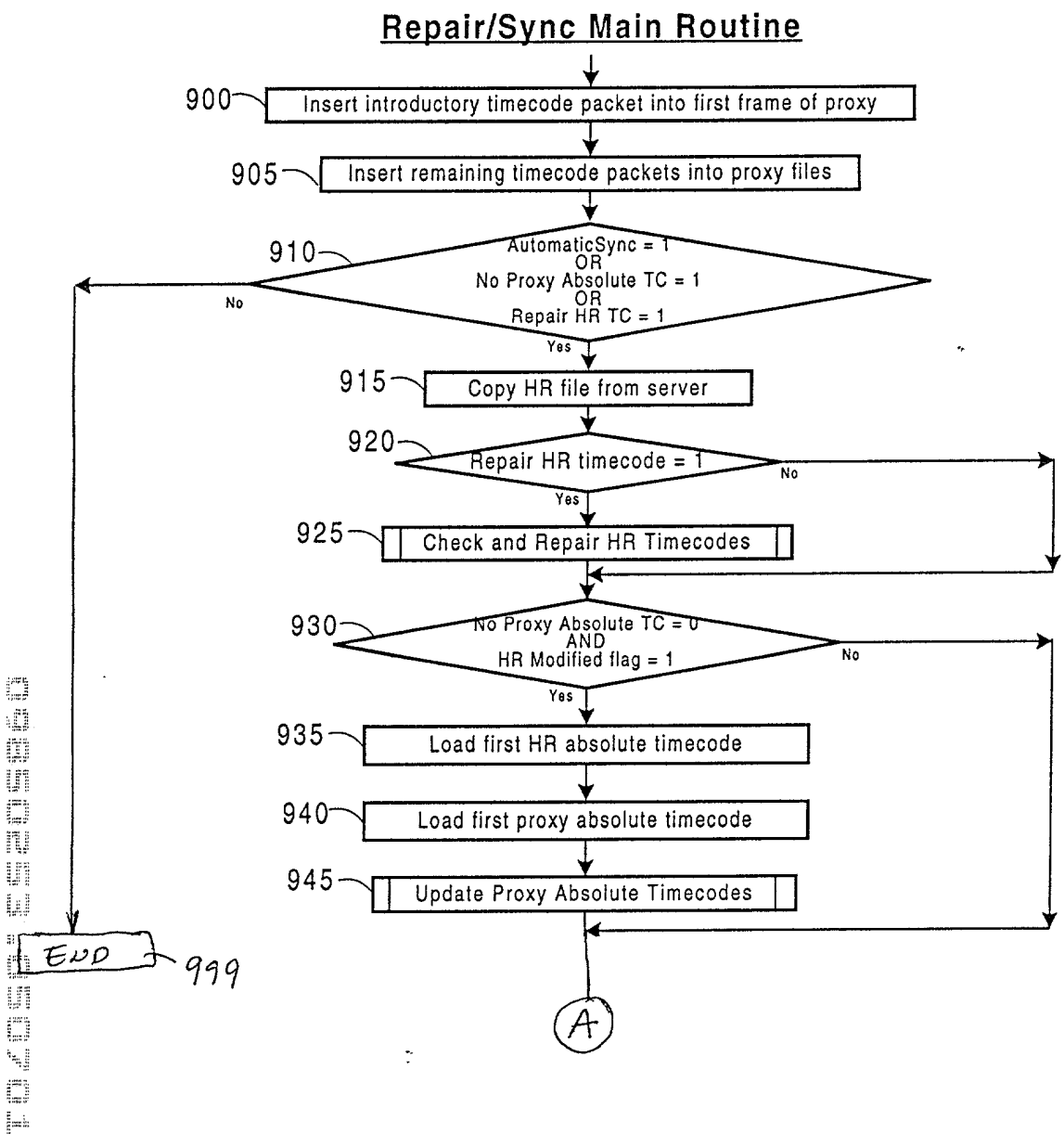

Repair/Sync Main Routine
900
Insert introductory timecode packet into first frame of proxy
905
Insert remaining timecode packets into proxy files
910
AutomaticSync = 1
OR
No Proxy Absolute TC = 1
OR
Repair HR TC = 1
No
Yes
915
Copy HR file from server
920
Repair HR timecode = 1
No
Yes
925
Check and Repair HR Timecodes
930
No Proxy Absolute TC = 0
AND
HR Modified flag = 1
No
Yes
935
Load first HR absolute timecode
940
Load first proxy absolute timecode
945
Update Proxy Absolute Timecodes
END
999
A

FIG. 9A

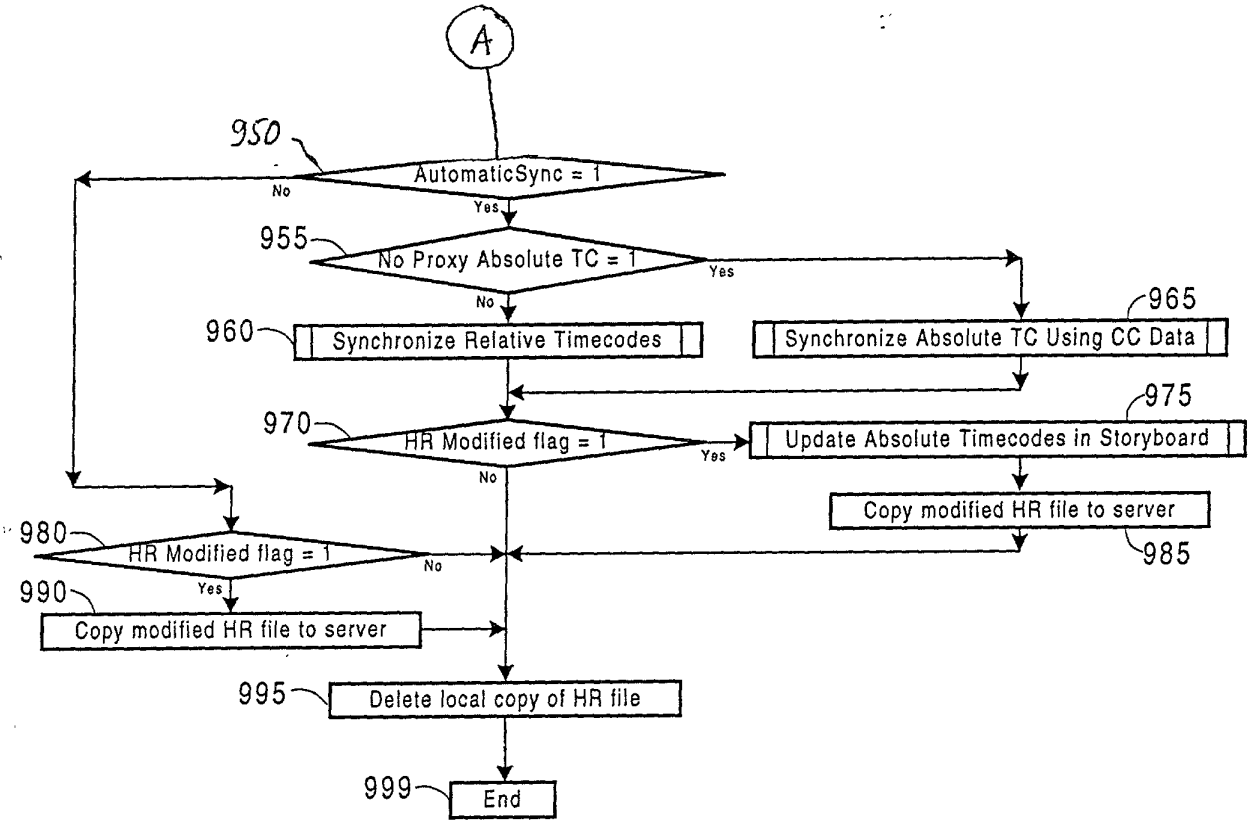

A
950
AutomaticSync = 1
No
Yes
955
No Proxy Absolute TC = 1
Yes
No
960
Synchronize Relative Timecodes
965
Synchronize Absolute TC Using CC Data
970
HR Modified flag = 1
Yes
No
975
Update Absolute Timecodes in Storyboard
Copy modified HR file to server
985
980
HR Modified flag = 1
No
Yes
990
Copy modified HR file to server
995
Delete local copy of HR file
999
End

Figure 9B

Patent Application Publication

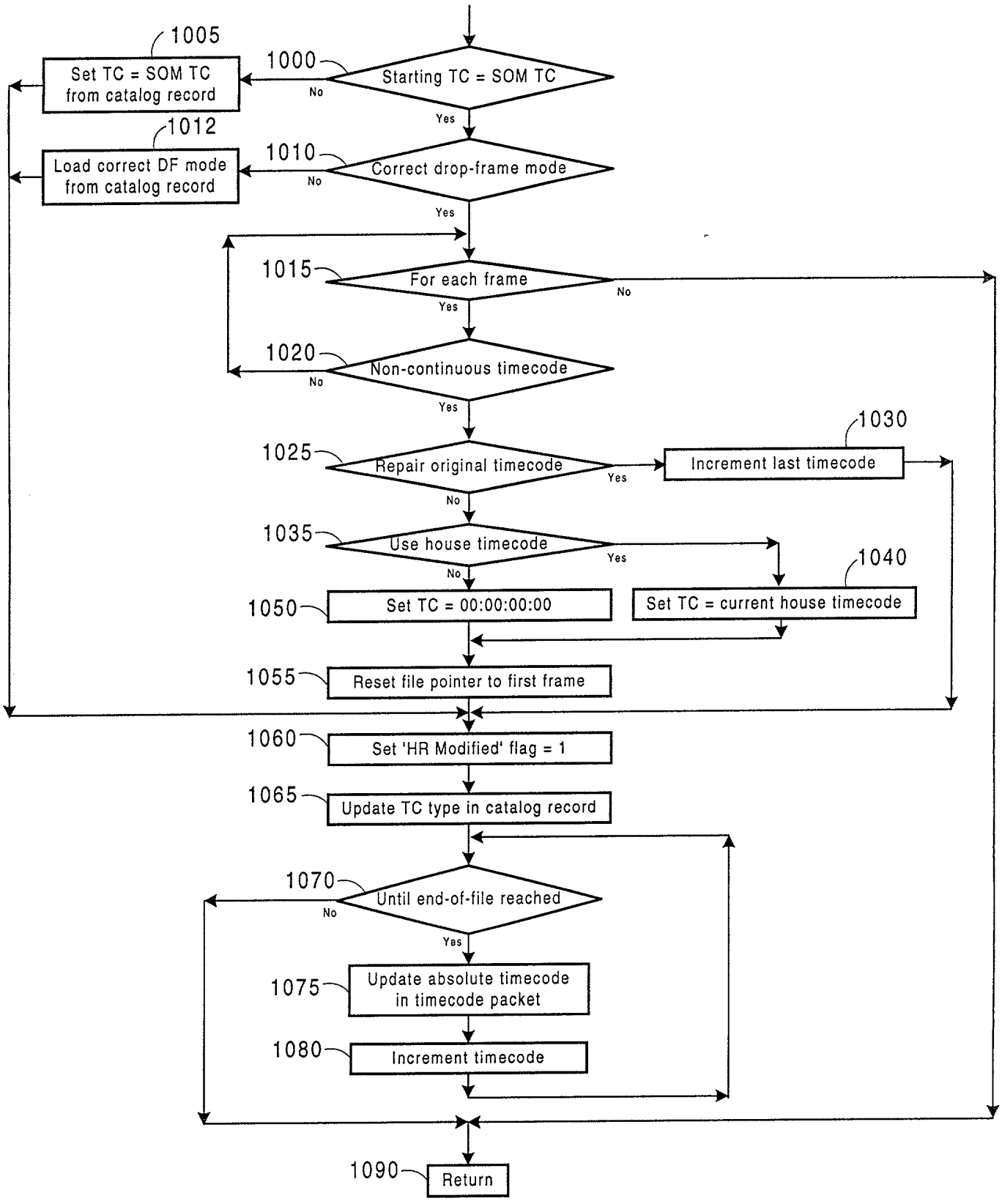



Figure 10

## Update Proxy Absolute Timecode

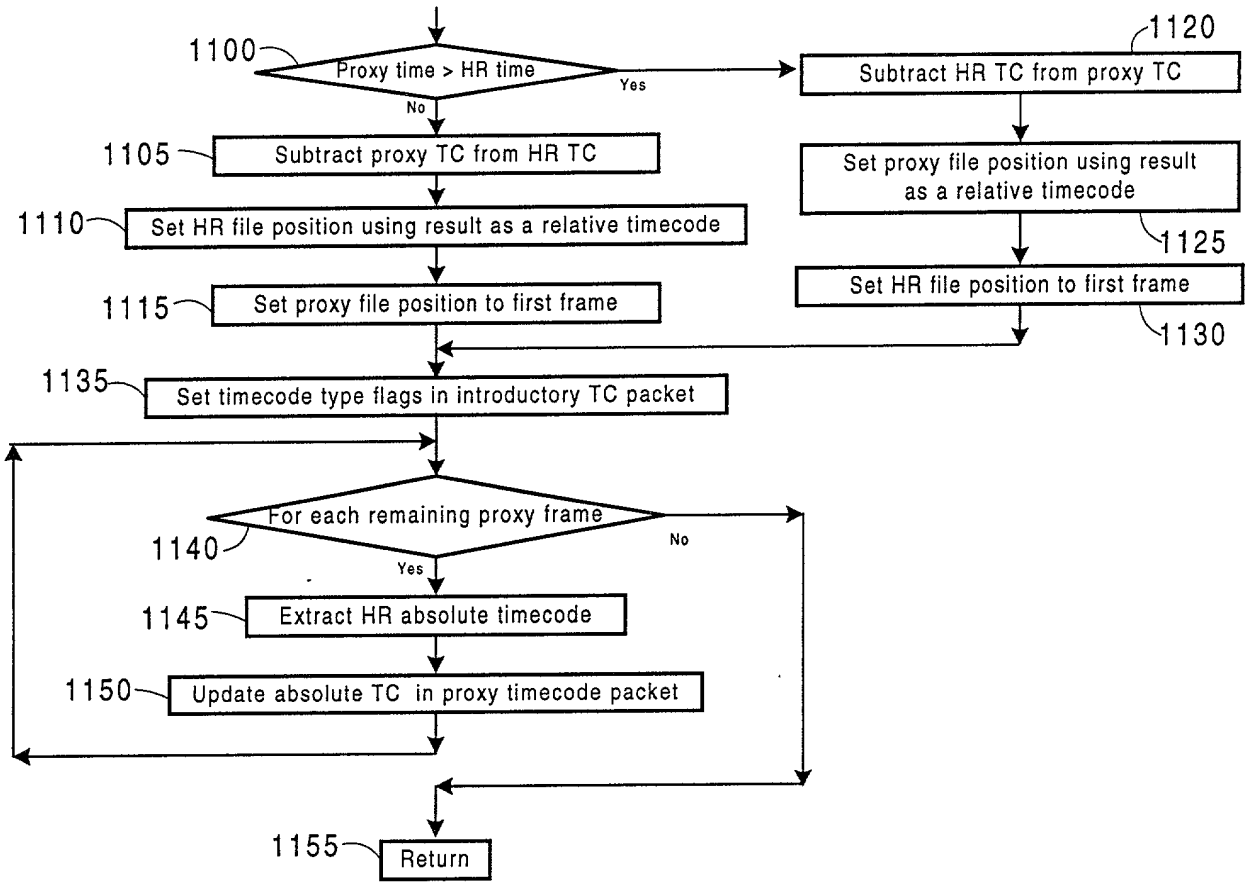



Figure 11

Express Mail Label No. EL 524 805 050 US

## Synchronize Relative Timecode

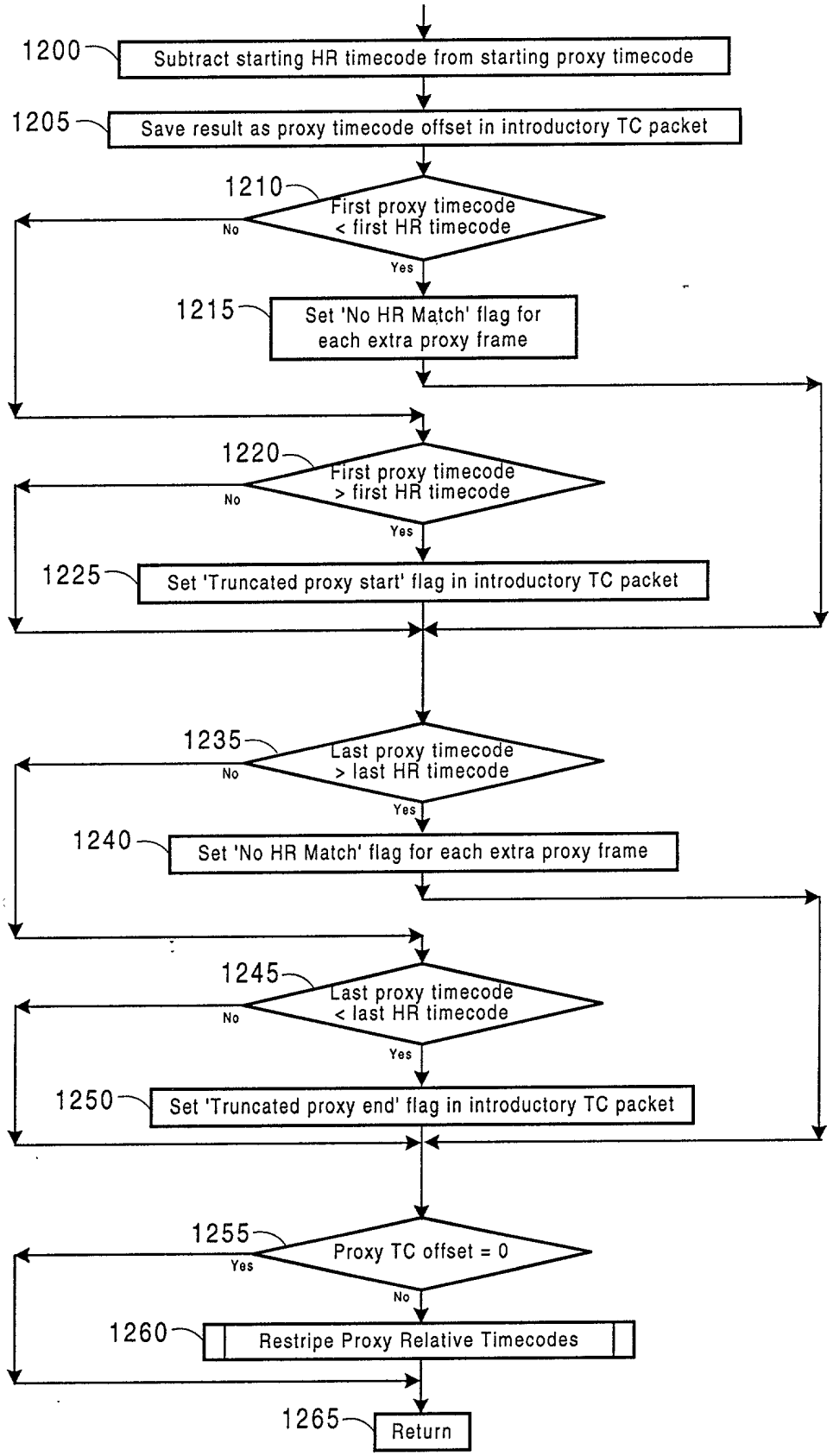



Figure 12

## Restripe Proxy Relative Timecodes

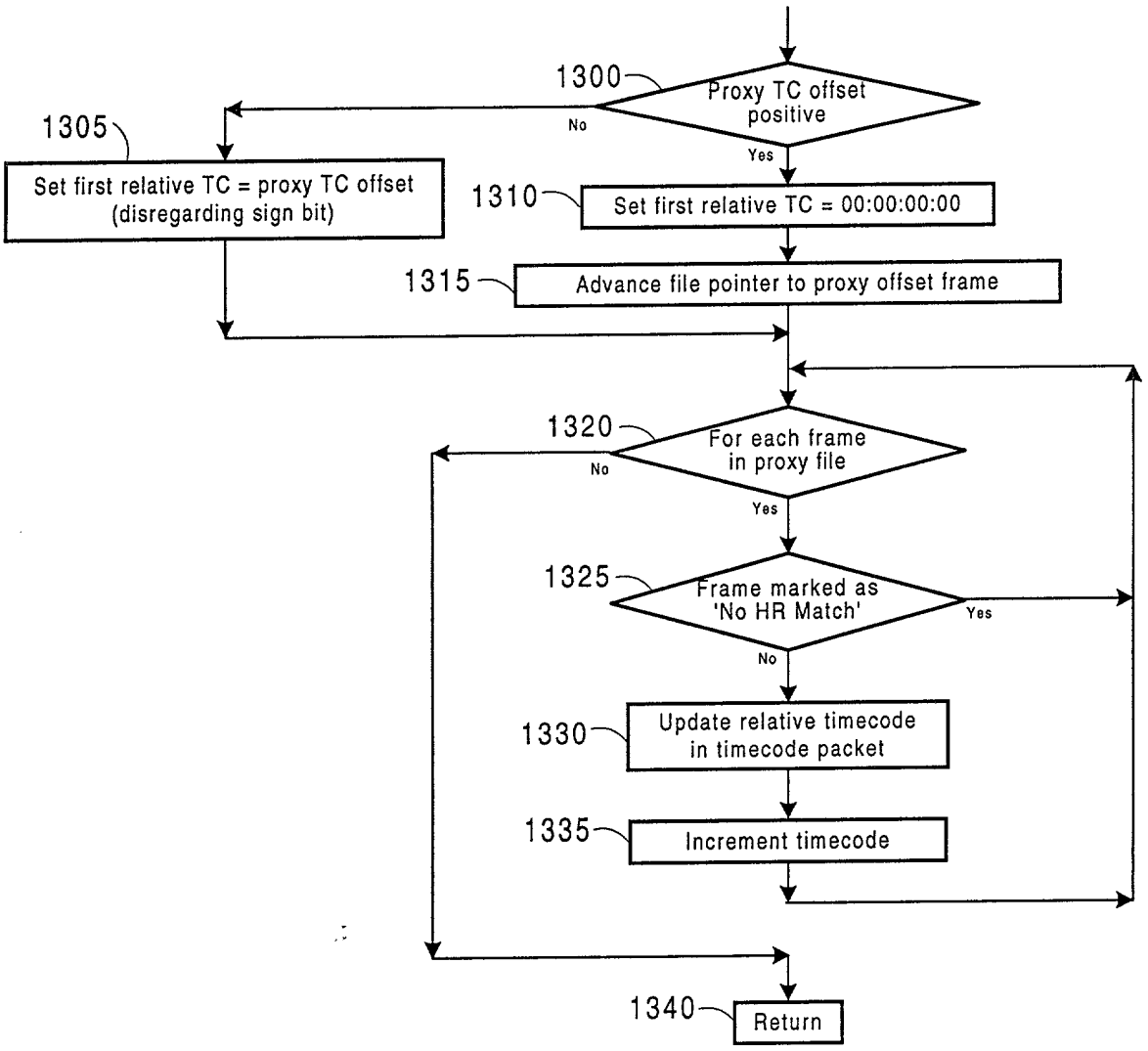



Figure 13

## Synchronize Absolute Timecode using CC Data

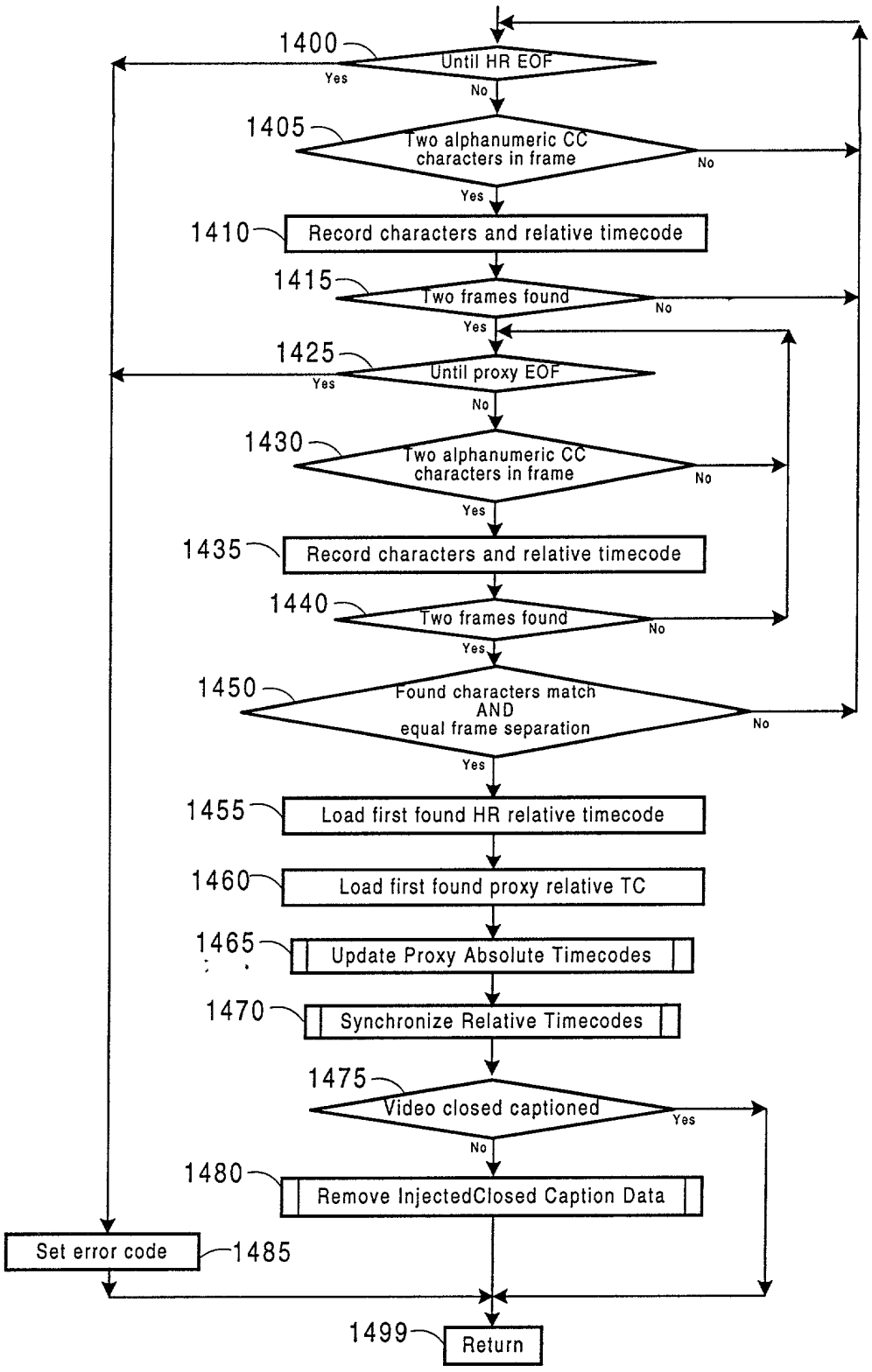



Figure 14

## Remove Injected Closed Caption Data

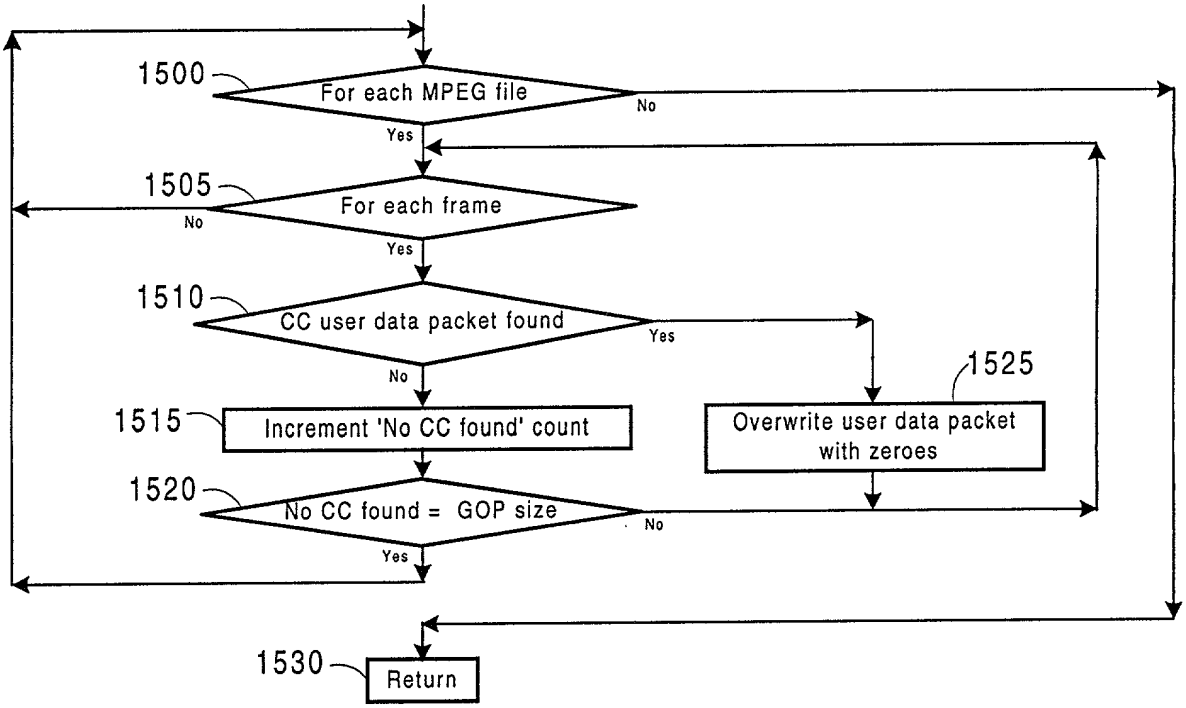



Figure 15A

## Update Absolute Timecodes in Storyboard

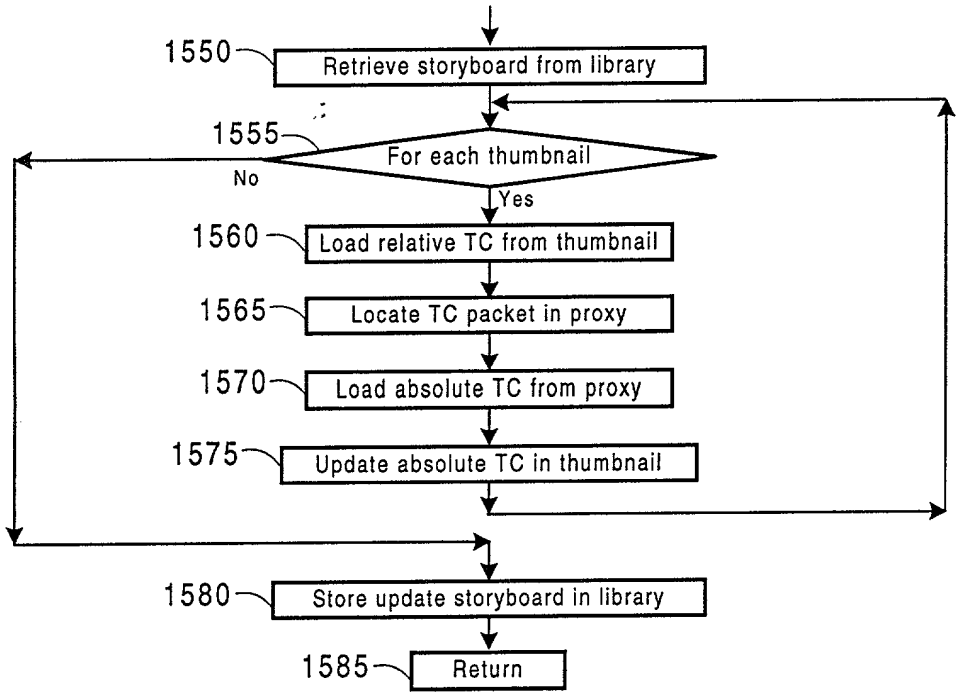



Figure 15B

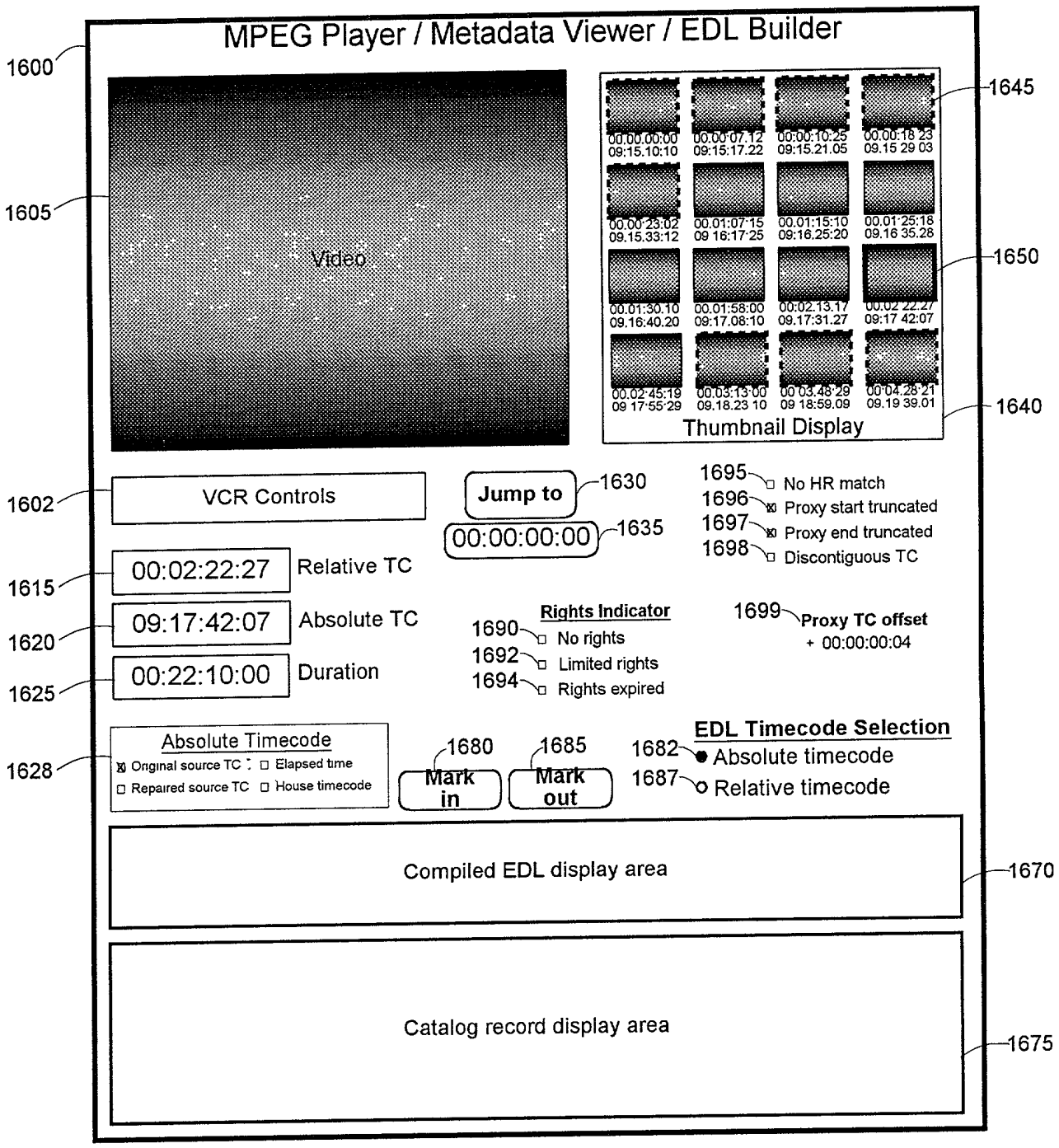

MPEG Player / Metadata Viewer / EDL Builder
1600
1605
Video
1645
1650
1640
Thumbnail Display
1602
VCR Controls
Jump to
1630
00:00:00:00
1635
1695 No HR match
1696 Proxy start truncated
1697 Proxy end truncated
1698 Discontiguous TC
1615
00:02:22:27
Relative TC
1620
09:17:42:07
Absolute TC
1625
00:22:10:00
Duration
Rights Indicator
1690 No rights
1692 Limited rights
1694 Rights expired
1699 Proxy TC offset
+ 00:00:00:04
1628
Absolute Timecode
Original source TC
Elapsed time
Repaired source TC
House timecode
1680
Mark in
1685
Mark out
EDL Timecode Selection
1682 Absolute timecode
1687 Relative timecode
Compiled EDL display area
1670
Catalog record display area
1675

Figure 16

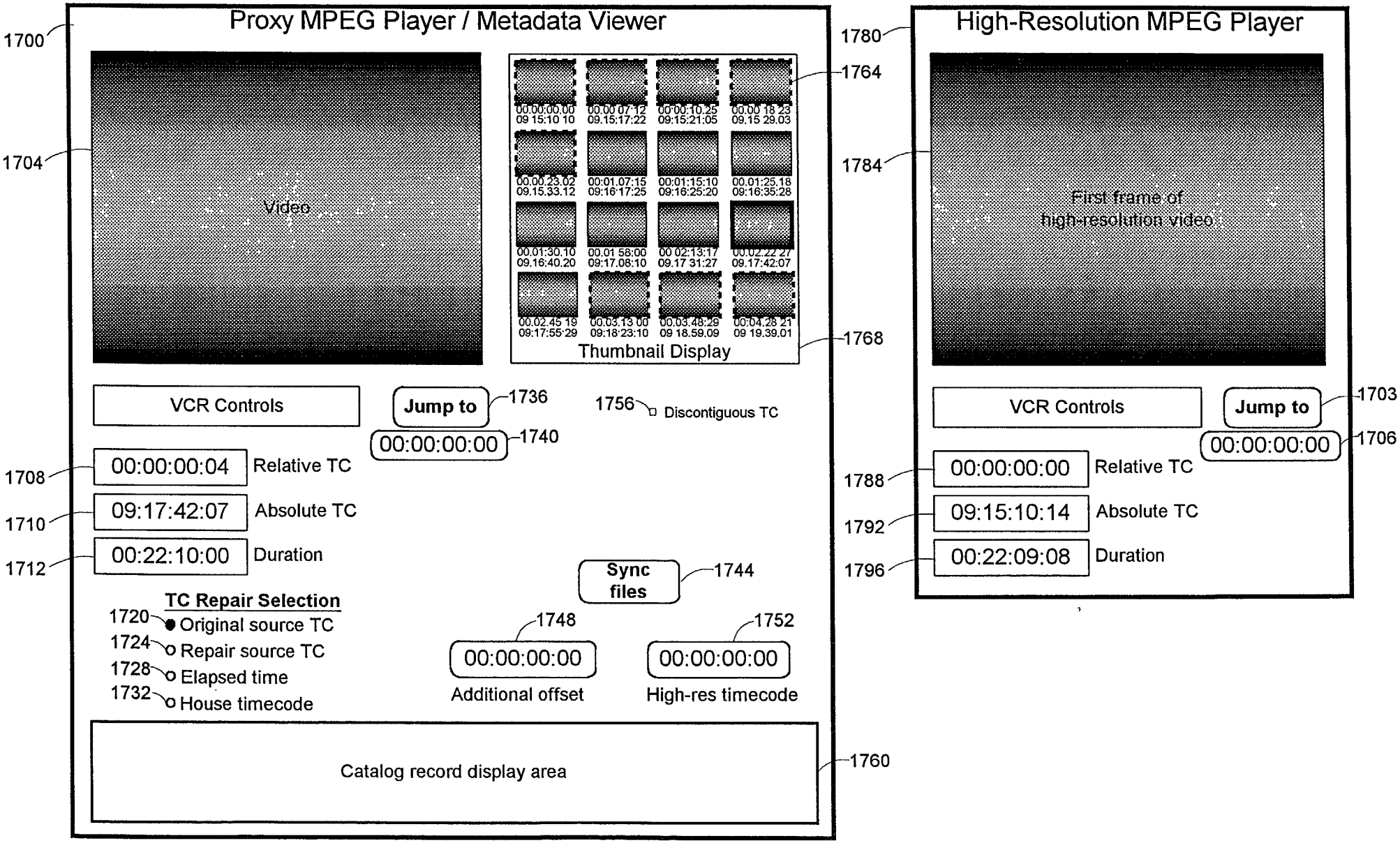

Proxy MPEG Player / Metadata Viewer
1700
1704
Video
1764
00:00:00:00 09:15:10:10
00:00:07:12 09:15:17:22
00:00:10:25 09:15:21:05
00:00:18:23 09:15:29:03
00:00:23:02 09:15:33:12
00:01:07:15 09:16:17:25
00:01:15:10 09:16:25:20
00:01:25:18 09:16:35:28
00:01:30:10 09:16:40:20
00:01:58:00 09:17:08:10
00:02:13:17 09:17:31:27
00:02:22:27 09:17:42:07
00:02:45:19 09:17:55:29
00:03:13:00 09:18:23:10
00:03:48:29 09:18:59:09
00:04:28:21 09:19:39:01
Thumbnail Display
1768
VCR Controls
Jump to
1736
00:00:00:00
1740
1756
Discontiguous TC
1708
00:00:00:04
Relative TC
1710
09:17:42:07
Absolute TC
1712
00:22:10:00
Duration
TC Repair Selection
1720
Original source TC
1724
Repair source TC
1728
Elapsed time
1732
House timecode
Sync files
1744
1748
00:00:00:00
Additional offset
1752
00:00:00:00
High-res timecode
Catalog record display area
1760
1780
High-Resolution MPEG Player
1784
First frame of high-resolution video
VCR Controls
Jump to
1703
00:00:00:00
1706
1788
00:00:00:00
Relative TC
1792
09:15:10:14
Absolute TC
1796
00:22:09:08
Duration

Figure 17